

Heat- and pressure-resistant bottle with increased oxygen barrier

DESCRIPTION

BACKGROUND OF THE INVENTION

[Para 1] A plastic bottle is typically designed with thin walls to reduce material cost. The disadvantages associated with a thin-walled plastic bottle are that it has a relatively low tolerance for internal and external oxygen permeation, pressure, and heat. The reduced oxygen barrier limits the shelf life of the product inside the bottle, and the low tolerance for pressure and heat limits the selection of processing methods that can be used to fill, cap and otherwise handle the bottle. Conversely, a plastic bottle with a relatively thicker wall provides a greater oxygen barrier and can withstand greater internal and external pressure, as well as external heat. This allows the bottle to exhibit an increased shelf life and be used in more processing methods, including high-temperature filling and vacuum filling.

[Para 2] Further, a bottle made of plastic is typically and substantially flat on the closed body-forming portion surface to allow the bottle to stand upright and move conveniently through processing lines. The disadvantage with a flat-bottom plastic bottle is that for soft drinks and other pressure applications, the best design for the bottom of a bottle is a hemispherical one.

[Para 3] Those in the industry will recognize that the aforementioned disadvantage to a typical bottle, namely thin walls and a flat bottom, are not found in a common bottle preform, the predecessor to a bottle. However, a bottle preform is not made for retail use. There are several features of a bottle preform that make it unsuitable and impractical as a consumer product, such as the downwardly directed axial projection in the form of an elongated gate at the closed end of many bottle preforms, the superfluous material, the challenge with handling the preform during processing due to the hemispherical bottom, and the inconsistent inner diameter and outer diameter along the body-forming portion.

BRIEF SUMMARY OF THE INVENTION

[Para 4] The purpose of this invention is to provide a bottle that exhibits some of the benefits of a bottle preform without the disadvantages, such that it can be pragmatically used as a retail consumer bottle. Specifically, the benefits of this resistant bottle are increased tolerance for internal and external pressure, heat and oxygen permeation, over that of traditional plastic bottles. The increased tolerance for

internal and external pressure is a result of the invention's wall thickness and hemispherical-shaped bottom. The increased oxygen barrier and the increased heat tolerance are a result of the invention's wall thickness.

[Para 5] The benefits of increased resistance to internal and external pressure are that

- (1) the resistant bottle can be used with filling methods otherwise unsuitable for plastic bottles, such as vacuum filling;
- (2) the resistant bottle can be filled at pasteurization temperatures that exceed maximum temperatures for thin-walled bottles; and,
- (3) the resistant bottle is more durable than traditional plastic bottles.

[Para 6] The benefit of increased oxygen barrier is an increased shelf life for food-grade and other degradable contents.

[Para 7] The purpose of this invention is to also provide a bottle that can be filled and capped at high speeds. As a circumstance of the hemispherical bottom, the resistant bottle must sit in a tray during filling, capping and other processing activities. This could limit processing options because it is well established in the bottling industry that typical bottle-filling and bottle-capping machines need to process bottles that are standing freely upright and stable as they move along a processing line. This permits the machinery to grasp and hold the bottle in place during filling and capping. By means of a tray in which the invention sits, the invention is standing, but it is not freely standing. By means of a tray, the invention is also stable. To circumvent the need to stand freely, the resistant bottle is processed while in a tray. A polygonal-shaped stabilizing flange located near the opening of the invention eliminates the need for the resistant bottle to freely stand because it permits the resistant bottle to be held in place while seated in a tray. The flange has an even number of isometric, substantially straight outer surfaces; the minimum number of surfaces is six. A simple device or 'jig' whose perimeter is partially recessed to substantially matches more than half of the sides of the polygonal-shaped flange (specifically, one-half the number of surfaces plus one) can be placed against the flange of the resistant bottle to hold it in place and prevent rotation. The jig can be fashioned with any number of flange-shaped openings to hold several resistant bottles in a single row so they may be filled simultaneously using a small, low-cost, multi-head filling machine. While fixed in the jig, the row of vials may also be capped simultaneously without chance of rotation using a row of low-cost, pneumatic cappers. The resistant bottles can then be placed directly into a shipping carton without ever being removed from the tray. This saves time in the production process by allowing the entire case of product to be filled into a corrugated container in one step.

[Para 8] The purpose of this invention is to also provide a bottle that allows for easy and efficient application of shrink sleeves. The ease of application is partly a result of the invention's wall thickness along its body-forming portion. It is well known in the

bottling industry that a shrink sleeve is typically applied to a bottle after it has been filled and cooled when filling said bottle with a high temperature liquid product ("hot filling"). This is because the thin-walled body of a typical bottle expands as a result of the hot-filling process; the expansion will stretch or break the shrink sleeve. In contrast, the body-forming portion of the invention has thick walls and thus exhibits negligible expansion during a hot-filling process. This permits a shrink sleeve to be placed onto the body-forming portion of the resistant bottle prior to filling. If the resistant bottle is hot-filled, the sleeve shrinks as a result of radiant heat emanating outwardly from the high temperature product, without the aid of an external heat source, such as a heat tunnel.

[Para 9] The ease of shrink sleeve application is also partly a result of the invention's constant outer and inner diameters along the resistant bottle's body-forming portion. The shrink sleeve is applied to only the body-forming portion of the resistant container, which extends from the bottom of the open-ended mouth-forming portion to the top of the hemispherical-shaped base-forming portion. The constant diameter of the resistant bottle allows the shrink sleeve to be sized so that its inner diameter is only slightly large than the outer diameter of the resistant bottle's body-forming portion. When applied to the resistant bottle, the sleeve requires less heat for shrinkage than what is traditionally required by bottles with inconsistent outer diameters. The constant inner diameter of the invention allows for even heat distribution across the entire surface area of the shrink sleeve. At 170 degrees Fahrenheit, the liquid product induces complete sleeve shrinkage for most bottle plastics. This avoids the need for an additional heat source such as a heat tunnel and saves a step in the overall production process.

[Para 10] This invention is not dependent upon the specific type or design of the bottle finish. Any suitable finish may be used. Further, this invention is not dependent upon the process by which the resistant bottle is made.

BRIEF DESCRIPTION OF THE DRAWINGS

[Para 11] FIG. 1 is a vertical sectional view of the present invention particularly for containing fluids having a thick-walled perimeter and a hemispherical-shaped base-forming portion.

[Para 12] FIG. 2 is a horizontal top view of the present invention.

[Para 13] FIG. 3 is a horizontal sectional view of the present invention taken generally along the line 3—3 of FIG. 1 and shows the specific cross section of the body-forming portion.

DETAILED DESCRIPTION OF THE INVENTION

[Para 14] Body-forming portion 1 of the invention as shown in FIG. 1 is cylindrical and hollow with a minimum wall thickness 5 of 1.5mm and a maximum wall thickness of 4mm. The base-forming portion 2 is hollow and closed at the hemispherical end with a minimum wall thickness 5 of 1.5mm and a maximum wall thickness of 4mm. The mouth-forming portion 3 is hollow and open with a minimum wall thickness 5 of 1.5mm and a maximum wall thickness of 4mm.

[Para 15] Extruding from the outer perimeter of the mouth-forming portion 3 and perpendicular to the cylindrical surface area of the body-forming portion is a polygonal-shaped flange 4 as shown in FIG. 1 and FIG. 2 exhibiting a minimum of six substantially straight sides. The number of sides is even. FIG. 2 shows a top view of the mouth-forming portion.